NOTES ON AUSTRALIAN RHOPALOCERA WITH DESCRIPTIONS OF NEW SUBSPECIES AND LIFE HISTORIES

By A. N. Burns, B.Sc., Entomologist,
National Museum of Victoria

Family HESPERIDAE
Subfamily TRAPEZITINAE
Hesperilla flavescens flavescens Whs.
and
Hesperilla flavescens flavia Whs.

H. donnysa flavescens Whs. and *H. donnysa flavia* Whs. were described by Waterhouse (1927, 1941) as geographical races of *H. donnysa* Hew. *H. donnysa donnysa* Hew. was described in 1868 by Hewitson from specimens reputed to come from Moreton Bay, Queensland. This is clearly set out by Waterhouse (1937). Waterhouse expresses a doubt as regards Moreton Bay being the correct locality but, on a visit to England some years ago, established the fact that Hewitson did receive his eastern Australian material from near Brisbane. *H. donnysa* is not a common butterfly in southern Queensland and northern New South Wales. Its distribution extends through south-eastern, southern, and south-western Australia, where it has developed a number of geographical races. These are all listed by Waterhouse (1941) and may be annexed to the following regions:

H. donnysa donnysa Hew. The coastal portion of New South Wales about 40 miles south of Sydney to the Newcastle area.

H. donnysa icaria Whs. (1941). The northern race, from a point north of Newcastle to the Richmond River (N.S.W.), Burleigh Heads, and Brisbane, including Stradbroke Island, Queensland.

H. donnysa samos Whs. (1941). Apparently confined to the Blue Mountains, where it is a common butterfly at an altitude of 2000-3000 ft. A dark race slightly smaller than *icaria*.

H. donnysa patmos Whs. (1941). Far eastern Victoria, throughout Gippsland, the Dandenongs, parts of coastal Victoria (Inverloch, Frankston, Dromana), parts of the Western District, inland at Ararat, and the Grampians.

H. donnysa aurantia Whs. (1927). At present this is the only race named from Tasmania, where it occurs freely near Hobart (on Mt. Wellington) and other localities on the island.

H. donnysa diluta Whs. (1932). Found in South Australia, originally near Goolwa; also at Woods Well, Kingston, and Robe (Parsons). No doubt at other localities in the Coorong.

H. donnysa delos Whs. (1941). Near Adelaide, South Australia, chiefly in the hilly country, Mt. Lofty, Bridgewater, Aldgate, Woodside, also at Mt. Compass and Second Valley (F. Angel).

H. donnysa albina Whs. (1932). Western Australia, near and at Bunbury (H. L. Whitlock and A. N. Burns), Waroona (F. E. Wilson). This race appears to be centred around Bunbury. It is a rare butterfly during the spring, but appears in greater numbers during March.

H. donnysa galena Whs. (1927). Geraldton, Western Australia. This is a yellowish race, bred from pupae collected by Waterhouse at Geraldton.

H. donnysa flavia Whs. (1941). Near Adelaide, at St. Kilda, West Beach (F. Angel), and Henley Beach (Parsons). Probably at other coastal places in South Australia where its food plant occurs.

H. donnysa flavescens Whs. (1927). Until recently confined to Altona Bay, Victoria. Now also recorded from the Bellarine Peninsula and Ararat (F. E. Wilson).

With the exception of the races *flavescens, flavia,* and the upperside of *galena,* all the other races bear a resemblance to the typical form *donnysa donnysa*; but after careful examination of long series of the first two of the above-named races (only few specimens of *galena* are yet available for study) it appears conclusive that *flavescens* and *flavia* should be elevated to specific and sub-specific rank respectively. This has been based on considerable study of their life histories, breeding experiments, times of appearance, microscopic examination of genitalia, and an examination of long series of specimens bred and collected over the past few years.

Much valuable information has been gleaned from the recent studies of Goldschmidt (1940) and Mayr (1942), and an endeavour has been made to ascertain the necessary data on which to substantiate the claim that *flavescens* and *flavia* are now at the stage in which they are distinct species and sub-species respectively from *donnysa* and its other races. Various theories based on observation and experiment have been advanced with regard to the status of a species. It has been stated that subspecies are not incipient species, nor models for the origin of the species, but are simply blind alleys within a species, and the change from one species to another requires methods other than those afforded by an accumulation of micro-mutations.

Species have a separate existence, and do not grade into one another. Subspecies are similar forms or types which replace each other in geographical regions, whereas species can live in the same region or area without inter-breeding; thus one species is separated from another by a definite gap. It is in time that variation within a species is found—the formation of races and

species being due to genic differentiation and differentiation in the chromosome structure. Specific differences are clear-cut—with subspecies, intergrading may occur, but the stable specific characters remain, e.g., genital armature, etc. Gradation in subspecies may extend over a geographic range beginning with one particular type and ending with another, thus expressing the extremes of intergradation.

Modern research in genetics and evolution has demonstrated that subspecific differences are not only the result of one or two gene mutations, but are the outcome of many mutational steps, as well as additional chromosomal re-arrangements. Physiological differences are important, and these in dispersion and time give rise to geographical races. Species have a genetic origin, therefore the question arises, "Are the differences between geographical races phenotypical or genotypical?" Practically all genetic factors are embodied in the chromosomes, and in all normal individuals reproducing sexually there are two sets of homologous chromosomes, one from each parent, and the genes of the two homologous chromosomes in the same individual do not merge but segregate at the formation of gametes. This is simple Mendelian inheritance, and explains most genetic phenomena.

Speciation is normal and progressive, and gives rise to the origin of new species. Mutations are abnormal, and though they occur frequently, may not be adaptive, and even may be upsetting factors in the normal course of speciation. It is generally accepted that by the gradual building up of minor mutational degrees, eventually a stage is reached where a new species is evolved.

Within a species, or even more precisely within a subspecies, individuals of a population will vary (polymorphism), and these variants will be seen to fall into certain similar types. Rarely extreme variants occur, such as albinos (whites), or on the other hand melanic (dark) forms. Polymorphism may vary in geographical races which are widely separated geographically, and have been thus over a long period of time.

The geographical race or "subspecies" has hence become a specialized subdivision of the original species, and differs genetically and taxonomically from the other geographical races of the same species. In races not widely separated by geographical barriers, it is natural to consider that these differences would not be so marked, and intergradation might even occur. This shows the desirability, or rather necessity, for having large numbers of specimens from many localities for study and examination. It is generally accepted that all forms which produce fertile offspring belong to one species; this is the outcome of a process,

and forms which have attained this level have diverged physiologically to the extent that they can live in association with each other without interbreeding. Thus each species in a genus consists of a population of individuals which may replace another population geographically or ecologically, and each such group is reproductively isolated from other such groups.

Not all species, however, break up into geographical races; some species are static, others plastic, and upon this characteristic depends the ability to change gradually. The formation of a new species has been summarized as follows: "The geographic isolation from the parent species has brought about characteristics which make reproductive isolation certain if the two species are brought together" (Mayr).

Other theories exist regarding the origin of speciation:

(1) Semi-geographic, i.e., the origin of species gaps in zones of intergradation.

(2) Non-geographic or sympatric speciation. This would be either instantaneous or by ecological specialization, and would be confined within a single population or interbreeding unit.

If gradual, the idea is regarded as being possible through the formation of biological or ecological races which gradually build up differences, until the stage of specific distinctiveness is reached. Sympatric forms which are morphologicaly identical, but which may possess specific biological characters and are reproductively isolated, are called Sibling species, but must not be confused with geographical races.

Size as a character does not enter largely into the *donnysa flavescens* problem as it does in the classical example of the moth *Lymantria* and its various races; *donnysa* and its various races are all of similar size, and any great departure from the normal would be due to the influence of environmental characters.

The subspecies *samos* (Blue Mountains) is generally smaller and darker than *donnysa* and the races *patmos* and *icaria,* and can easily be picked and distinguished by visible characters. The females in particular have the hyaline markings clear-cut. *Patmos* (Victoria, excepting Altona Bay and parts of the Bellarine peninsula), *icaria* (northern N.S.W. and southern Queensland), *donnysa donnysa* (Sydney - Newcastle), *delos* (near Adelaide), and *diluta* (Coorong) all exhibit great similarity; if anything, *delos* is larger and a little more richly coloured than the other races; *diluta* is slightly paler, has a duller and wider sex mark in the male, and tends to have pinkish suffusion on the underside. The Tasmanian race, *aurantia,* has the hyaline markings richer

and deeper in colour than the mainland forms—and fresh specimens, especially females, have a faint plum-coloured suffusion on the underside.

The south-western Australian form *albina* has the markings on both sexes considerably reduced and paler in colour, and the underside has a definite brownish suffusion.

Galena is smaller than either *flavescens* or *flavia,* and not as yellow. In the male, the sex mark is wavy, brown, and oblique, and extends from just below vein 1A to just above vein 4, and the cilia are grey-brown. The underside of the male is much more like *donnysa,* and is greyish-brown. Although the upperside of the female resembles a small *flavescens,* the underside, too, is greyish-brown. The writer has not seen enough specimens yet to prove whether this race belongs to *donnysa* or *flavescens.* It is very unlike the south-western *albina,* and until many more specimens are collected and studied, and specimens of one or both obtained from between Geraldton and Perth, it must remain as a race of *donnysa.* Its food plant is *Gahnia trifida.*

In the case of *Lymantria,* a definite gradient in racial types parallels a climatic change. *H. donnysa* extends from the latitude of Brisbane, through coastal N.S.W., Victoria (chiefly south of the Divide), South Australia, and Western Australia from near Albany to Geraldton. This distribution presents a great diversity in climate from a mild and comparatively humid one, through one with warm dry summers and cold damp winters, to one with a fairly mild winter and a hot dry summer. Yet unless one was familiar with *donnysa* and its races, it is unlikely that it would be possible for other than a specialist to pick out specimens of each race from a large number of specimens and assign each to its correct region. This is excluding *samos,* which is a mountain form and darker, and *aurantia,* the Tasmanian form, which is also darker. *H. donnysa flavescens* and *flavia* have purposely been omitted here, and will be discussed later. This distribution, with the exception of Western Australia, is probably due to the ability of the species to widen its range, rather than to have been isolated in certain areas due to geological changes. Its occurrence, however, in Western Australia, with an apparent gap from South Australia, makes it appear to be a residual butterfly there. This seems also to apply to the Satyrid butterfly *Heteronympha merope duboulayi* (Butl.) and the Hesperid, *Trapezites sciron* (Whs. and Lyell) and other species which occur in that State as well as in the east of Australia.

H. donnysa appears to be fairly constant in its races, only two types of variation usually being found—one in which the central

hyaline patch of the hind wing in the female has one or two small orange dots, and that in which the third hyaline spot near the tornus in the forewing of the male is absent. Other much less apparent variations also occur. These are inherited in a simple Mendelian way, and do not bear any relation to any particular subspecies.

To define the limits of distribution of each of the subspecies referred to above, with the exception of *samos* (Blue Mountains) *aurantia* (Tasmania), and *albina* (W.A.), would be somewhat difficult. *H. donnysa donnysa,* from the Sydney-Newcastle area, is smaller than the northern race *icaria* (Whs.), and the species no doubt occurs right through the coastal country from Newcastle to Brisbane, wherever its food plant occurs. The Victorian race, *patmos,* is found from far eastern Gippsland across the State to the Grampians and the far south-western corner, and appears to be constant throughout.

Subspecies are the product of a number of micro-mutations brought about to cope with local conditions, climate, etc.—in the process of adaptation to environment in time. In the process of evolution, the transition of one stable organic system into another still stable system brings about the origin of the new species (Goldschmidt). This is possible only by means of an initial change in the chromosomes which then gives rise to the formation of a new and stable organism.

Of all the races of *H. donnysa donnysa, flavescens* and *flavia* are outstanding; the factors governing their separation as a distinct species (*flavescens*) with a geographical race (*flavia*) will be set out hereunder. *Flavescens* was first recorded by the late F. P. Spry, then Entomologist of the National Museum of Victoria, from Altona Bay, Victoria, in 1927, where it breeds on *Cladium filum,* a clumpy sword or "cutty" grass which grows in the swamps behind the shore-line. A spring and autumn brood are produced, the first appearing during October and early November, and the latter during March and early April. The species was also taken by the author during October-November, 1946, at several places at Lake Coonewarre near Barwon Heads, where it was breeding on *Cladium filum.*

It is of interest that *H. donnysa patmos* occurs within 20 miles of Altona Bay (near Box Hill), where it breeds on *Gahnia radula.* It, too, produces a spring and an autumn brood, the former appearing during November and early December, and the latter during March. Of several hundred specimens bred over a period of three years from larvae and pupae collected within 25 miles of Melbourne (excepting Altona Bay), in addition to many captured

specimens, no *flavescens*-like specimen has been observed. Likewise, of over 250 specimens of *flavescens* bred from Altona Bay, no *donnysa patmos* type has been noted. Although the difference in the food plant of these insects is an important point, it is not, however, in itself sufficient to prove the specificity of *flavescens*.

Another point worthy of consideration is that *flavescens* appears on the wing from three weeks to a month earlier than *patmos,* so that when one is finishing the other is only beginning.

These facts led to a detailed study of *flavia,* which occurs at St. Kilda, Henley Beach, West Beach, and other low-lying coastal places near Adelaide, where the food plant grows. This is *Cladium filum,* and during August, 1947, when the writer was in Adelaide, a visit was made to St. Kilda, in company with N. B. Tindale of the South Australian Museum, and F. Angel of Parkside, Adelaide, where a large number of larvae and pupae was collected. As with *flavescens,* these began emerging fully three weeks in advance of *H. donnysa delos* (Whs.) from the Adelaide hills. I am indebted to Mr. F. Angel for specimens and much valuable information relative to the above species.

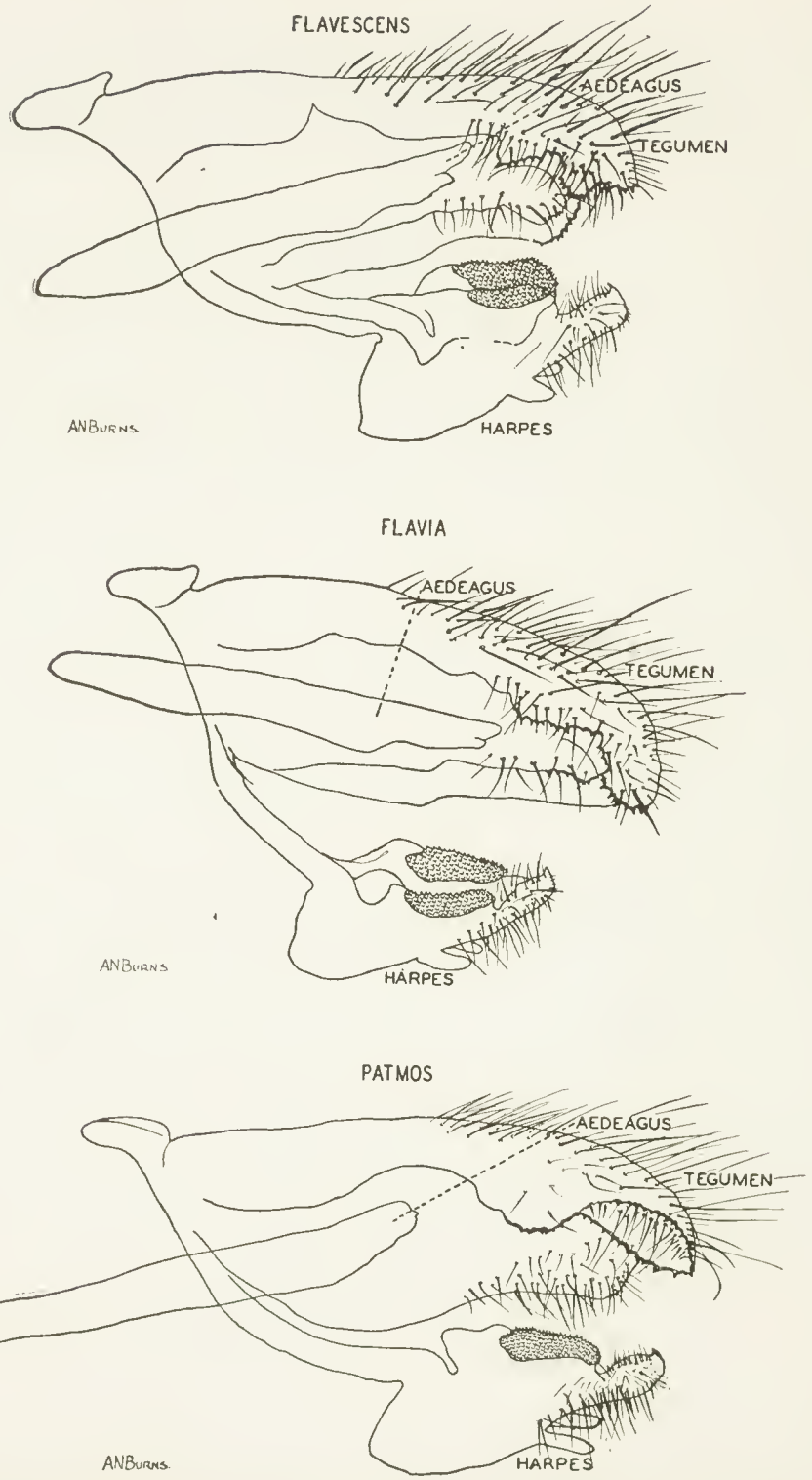
H. donnysa patmos is not confined to feeding on *Gahnia radula*; occasionally it is found feeding on *Gahnia psittacorum,* but, as far as the writer is aware, has not been recorded as feeding on *Cladium filum.*

In July, 1947, at Ararat, Victoria, F. E. Wilson collected three *donnysa* type skipper larvae from a sword grass which resembled *Gahnia radula*; these he was successful in breeding to the adult stage. There were one male and two females, all of which bear a very strong resemblance to *flavescens.* Close examination of and comparison with *flavescens* shows them to be this species. They all emerged from pupae in early November, 1947.

Slides were made of the male genitalia of *donnysa patmos, flavescens* and *flavia,* the specimens coming from Ferntree Gully, Victoria, Altona Bay, Victoria, and St. Kilda, S.A., respectively. Careful examination of these shows considerable differences which are detailed in the camera lucida drawings.

M. W. Mules carried out an interesting experiment in 1948, when he caged 12 freshly emerged males with 12 freshly emerged females of *donnysa patmos,* but results were entirely negative in that no pairs mated.

In the spring of 1947 the writer placed several three-quarter grown larvae of *flavescens* on *Gahnia radula* (food plant of *donnysa patmos*), but they refused to feed. This, however, does not



Male genitalia of *Hesperilla flaveseens flaveseens* Whs., *Hesperilla flavescens flavia* Whs., and *Hesperilla donnysa patmos* Whs.

necessarily mean that they would not do so if placed on this plant when very young.

Accurate enlarged colour drawings of the larvae and pupae of *flavescens, flavia,* and *patmos* have been made by P. J. O'Brien, late Preparator of the National Museum. The drawings were made in each case from an average specimen selected from a number, and some interesting differences are apparent; these are set out in the descriptions of the larvae and pupae hereunder:

Hesperilla flavescens Whs.

Larva. Length (average) $1\frac{1}{4}$ inches (32 mm.)

Colour: Body—Apple green, tinged bluish at junction of segments. Dorsal line dull green, much darker than body; ventral surface bright green slightly tinged blue. Head—Coriaceus, yellowish green slightly tinged brown; a wedge-shaped marking narrowing from mandibles to back of head, dull piceus. A moderately wide stripe on the sides of the head from base of mandibles to back of the head in some specimens, in others to half way or further, piceus. Mandibles shining black. Anal Plate—Indistinctly blue-green with numerous small black granules. From anal end of plate just before the margin about 8 bristle-like setae, brown. Extreme margin fringed with very fine white setae. Spiracles—Light brown, first larger than the others, transversely oval, last slightly larger than medians, also transversely oval, medians round. Prolegs—Hyaline tipped black. Claspers—Bright green, hooks blackish.

Food plant: *Cladium filum.*

Pupa. Length (male) $\frac{7}{8}$ inch (22-24 mm.); (female) 1 inch or a little more (26-28 mm.).

Colour: Dark piceus, margin of wing cases much diluted, abdominal segments with fairly short brownish setae, many of which arise from umbilicate pustules. Cremaster—Black, fringed with fairly long brown setae. Operculum—Nitid, tripartite, coarsely sculptured and clothed with fine reddish setae. A tuft of short setae on each shoulder, brown.

Dorsal surface of abdominal segments with umbilicate pustules sparse on basal segments, increasing in size and number towards apex.

Localities. Altona Bay, near Lake Coonewarre, and Ararat, Vic.

The writer recently visited St. Kilda, S.A., where *flavia* occurs; the type of country and general ecology is identical with that where this species occurs.

Adult

Male. Above: Forewing brown, suffused yellow giving a yellowish-brown appearance. A series of from 2 to 5 small subapical spots hyaline yellow, an elongate spot at distal end of cell darker hyaline yellow, and a series of from 3 to 4 similar discal spots. The extent of the yellow suffusion varies in individuals, and may extend from over half way from the base to completely covering the wing. Sexmark grey-brown, oblique, normally from just below vein 1A to just above vein 4. Cilia greyish white.

Hindwing brown suffused yellow, a central dark yellow spot slightly hyaline. In some specimens there may be one or two minute yellow dots immediately below and bordering the central marking. Cilia greyish white.

Beneath: Forewing apex extending almost to tornus pale ashy grey; apical, cellular, and discal spots indistinctly as above; below the subapical spots a dull

black patch; the area from distal end of and below cell also black. Cilia greyish white.

Hindwing greyish white faintly suffused yellowish or pale ashy grey, a small central spot sometimes whitish, narrowly encircled dull black, sometimes reduced to a small dull black spot. A curved series of 6 or 7 similar spots extending from near apex to near dorsum. Cilia greyish white.

Female. Above: Forewing brown suffused yellow, this suffusion usually being more pronounced than in the male. A series of from 4 to 5 subapical spots hyaline yellow, an elongate spot at distal end of cell darker hyaline yellow, and a series of from 3 to 5 similar discal spots. In some specimens these spots coalesce to form an irregular band. Sexmark absent. Cilia greyish white.

Hindwing brown suffused yellow, a moderately large central marking dark yellow, very slightly hyaline. As in the male, there may be one or two small yellow circular dots immediately below and bordering the central marking. Cilia greyish white.

Beneath: Forewing similar to the male, spots larger and more clearly defined, an obscure dull black streak in the yellow of the cell.

Hindwing also as in the male, the central spot sometimes whitish and only faintly visible, the narrow dull black encircling margin sometimes being absent. The curved series of spots as in the male and varying in number in individuals, from 5 to 7. Cilia greyish white.

Distribution. Victoria: Altona Bay, Bellarine Peninsula near Lake Cooneworre, and Ararat.

Hesperilla flavescens flavia Whs.

Larva. Length (average) 1¼ inches (32 mm.).

Colour: Body—Apple green, tinged bluish at junction of segments. Dorsal line dull green, much darker than body; ventral surface bright green, slightly tinged blue. Head—Coriaceus, yellowish green slightly tinged brown; a wedge-shaped marking narrowing from mandibles to back of head, dull piceus. A moderately wide stripe on the sides of the head from base of mandibles to the back of the head in some specimens, in others to half way or further, piceus. Mandibles shining black. Anal Plate—Indistinctly blue-green with numerous small black granules. Just before margin about 8 bristle-like setae, brown, a few shorter semi-erect ones between. Extreme margin fringed with very fine white setae. Spiracles—Light brown, first larger than the others, transversely oval, last slightly larger than medians, also transversely oval, medians round. Prolegs—Hyaline tipped brown-black. Claspers—Bright green, hooks brown.

Food plant: *Cladium filum.*

Pupa. Length (male) ¾ inch (22-24 mm.); (female) 1 inch (25-27 mm.).

Colour: Dark piceus, margins of wing cases much diluted, abdominal segments with fairly short setae, many of which arise from umbilicate pustules. Cremaster—Black, fringed with long brown setae. Operculum—Nitid, tripartite, coarsely sculptured and clothed with fine reddish setae. A tuft of short setae on each shoulder, brown.

Dorsal surface of abdominal segments with umbilicate pustules, sparse on basal segments, increasing in number towards apex. In this subspecies these pustules tend to extend further laterally, especially in male pupae, than in *flavescens.*

It is doubtful if this really warrants a racial name, close examination of long series of specimens showing it to present exactly the same types of variation as *flavescens*. The tendency for the discal spots in the forewing of the female to coalesce and form an irregular band as in *flavescens* occurs in about the same percentage of specimens. The sexmark in the male is also oblique and greyish brown. The food plant is the same (*Cladium filum*) and the insect is found in precisely similar localities on the swampy flats near the sea.

In company with N. B. Tindale and F. Angel of Adelaide the writer was able to visit St. Kilda near Adelaide and collect a number of larvae and pupae—these, as the accompanying figures show, are identical with those of *flavescens*; the feeding habits and shelters made by the larvae also agree in every way.

Distribution. South Australia: St. Kilda, West Beach, and other places near the sea where the food plant grows.

Hesperilla donnysa patmos Whs.

Larva. Length (average) 1¼ inches (32 mm.).

Colour: Body—Yellowish green, darker green at junctions of segments laterally and at base of prolegs. Ventral surface slightly darker and less yellowish. Surface of body with very minute scattered brown setae arising from minute granules, these interspersed sparsely with very fine white setae. Head—Brownish green, finely granulate, a wedge-shaped marking narrowing from mandibles to back of head, pieeus; a very fine brown line running down middle from vertex to half way, where it forks and runs to the margin of markings at mandibles. A wide stripe on sides of head sometimes from base of mandibles to back of head, sometimes only part of the way, pieeus. Mandibles shining black. Anal Plate—Yellowish green with numerous small black granules; from end and sides just before margin 6 long brown setae, extreme margin with a few fairly long brown setae tipped white, interspersed with a few shorter white setae. Spiracles—Light brown, first larger than the others, transversely oval, last slightly larger than median ones, also transversely oval, medians round. Prolegs—Hyaline tipped shining pale brown. Claspers—Yellowish green, hooks light brown.

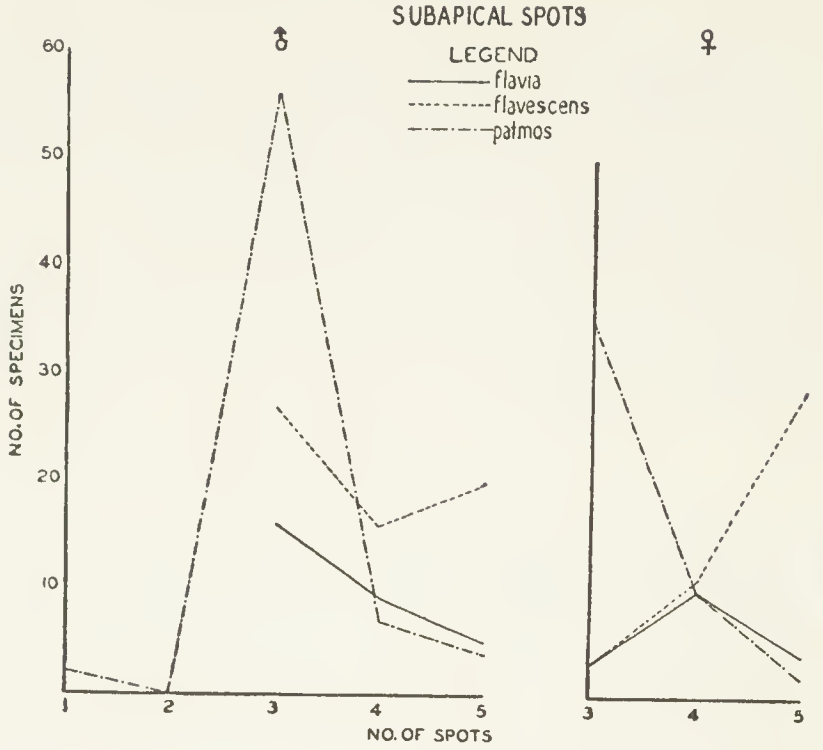
Food plant: *Gahnia radula,* rarely *G. tetragonocarpa* and *G. psittacorum.*

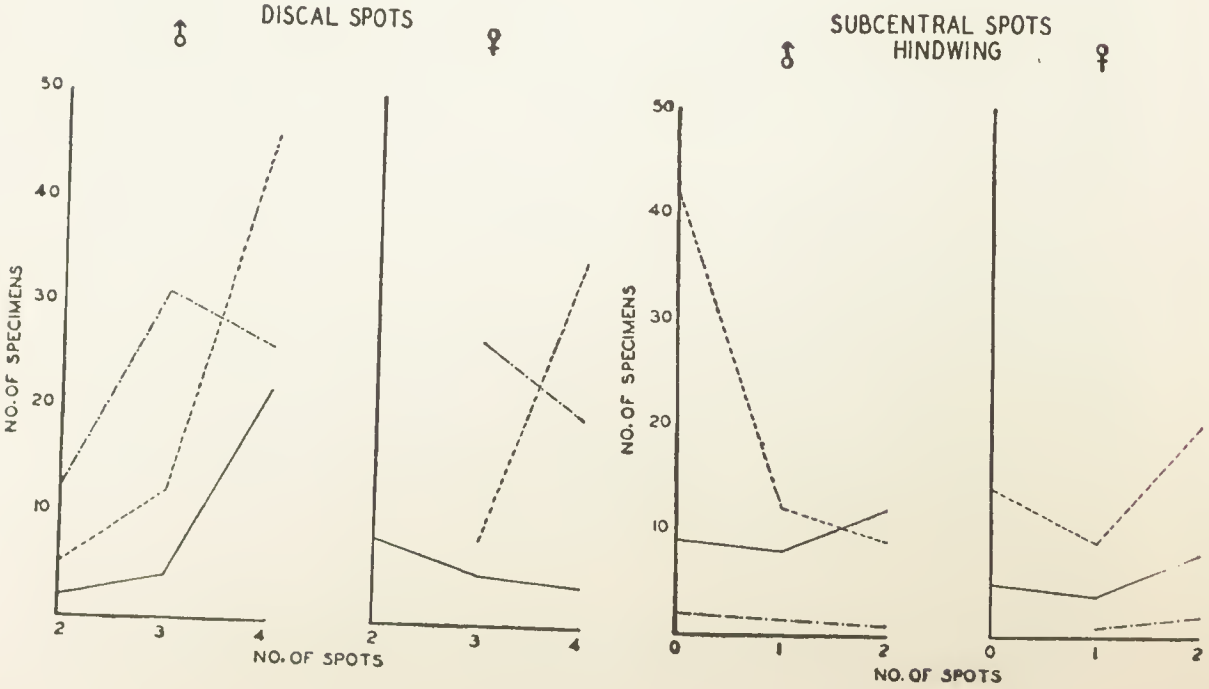
Pupa. Length (male) ⅞ inch almost to 1 inch (23-25 mm.); (female) 1 inch or a little more (25-27 mm.).

Colour. Dark pieeus, margin of wing cases much diluted, usually more so in male pupae, and suffused greenish; junctions of abdominal segments lighter in colour, also suffused greenish, and with fairly short brown setae arising from umbilicate pustules which are sparser on basal segments, and increase in size and number towards apex. Cremaster—Black, fringed with long brown setae. Operculum—Nitid, tripartite, coarsely sculptured angularly, dotted sparsely with fine reddish brown setae; palpal shields dark brown, almost black. A tuft of setae on each shoulder, reddish brown.

Sexmarks. (Found only in males.)

1. *Hesperilla donnysa donnysa* Hew. Dull black, extends from below vein 1A to vein 4. Narrow and nearly uniform.
2. *Hesperilla donnysa icaria* Whs. Dull black, extends from below vein 1A to vein 4. Broadest near 4, gradually narrowing towards 1A.


SUBAPICAL SPOTS
♂
♀
LEGEND
flavia
flavescens
palmos
NO. OF SPECIMENS
60
50
40
30
20
10
1
2
3
4
5
NO. OF SPOTS
3
4
5


DISCAL SPOTS
♂
♀
NO. OF SPECIMENS
50
40
30
20
10
2
3
4
NO. OF SPOTS
SUBCENTRAL SPOTS
HINDWING
♂
♀
NO. OF SPECIMENS
50
40
30
20
10
0
1
2
NO. OF SPOTS

3. *Hesperilla donnysa samos* Whs. Dull black, extends from below vein 1A to vein 4, praetically uniform.
4. *Hesperilla donnysa patmos* Whs. Dull black, extends from below vein 1A to vein 4, usually slightly widening towards 4.
5. *Hesperilla donnysa delos* Whs. Dull black, extends from below vein 1A to vein 4, almost uniform.
6. *Hesperilla donnysa diluta* Whs. Dull black, extends from below vein 1A to vein 4, sometimes broadening towards 4.
7. *Hesperilla donnysa aurantia* Whs. Dull black, extends from below vein 1A to vein 4. In some examples inclined to be interrupted, usually almost uniform.
8. *Hesperilla donnysa albina* Whs. Dull blaek, extends from below vein 1A to vein 4. Narrow, almost uniform, sometimes slightly interrupted.
9. *Hesperilla donnysa galena* Whs. Greyish black, oblique, extends from below vein 1A to vein 4. Irregular and of uniform width.
10. *Hesperilla flavescens flavescens* Whs. Obliquely greyish black, extends from below vein 1A to vein 4. In some speeimens almost uniform, usually not interrupted, narrow.
11. *Hesperilla flavescens flavia* Whs. Obliquely greyish blaek, extends from below vein 1A to vein 4. In some specimens widest near 4, gradually narrowing towards 1A, in others almost uniform, generally not interrupted.

Table showing extremes in variation of markings in H. flavescens, H. flavescens flavia, and H. donnysa patmos

Males						Females					
					flavescens						
Total Specimens examined, 63 males, 43 females											
No. Spec.	Discal Spots	No. Spec.	Sub-Apical Spots	No. Spec.	Sub-Central Spots	No. Spec.	Discal Spots	No. Spec.	Sub-Apical Spots	No. Spec.	Sub-Central Spots
46	4	20	5	9	2	35	4	29	5	20	2
12	3	16	4	12	1	8	3	11	4	9	1
5	2	27	3					3	3		
					flavia						
Total Specimens examined, 29 males, 17 females											
23	4	5	5	12	2	4	4	4	5	8	2
4	3	9	4	8	1	5	3	10	4	4	1
2	2	15	3			8	2	3	3		
					patmos						
Total Specimens examined, 69 males, 47 females											
26	4	4	5	1	2	20	4	2	5	1	1
31	3	7	4			27	3	10	4	2	2
12	2	56	3					35	3		
		2	1								

Deductions made from Table and Graphs

Subapical Spots

The *flavescens* and *flavia* graphs V in the opposite direction to the *patmos* graph.

Flavescens males tend to a high number with 3 and 5 spots, but fewer with 4, thus showing strongly a variation within the species of greater numbers with the maximum and minimum number of spots. In the females the tendency towards the maximum is more marked.

Flavia males show a decreasing tendency towards the maximum number; this is slightly more marked in the females. This may be a pointer towards a geographical difference.

Patmos shows 3 spots to be typical in the males, and in the females the greatest number exhibited the same number. Thus in all three the typical number of spots is 3, but the number distribution is very different, particularly with *patmos* as compared with *flavescens* and *flavia*.

Discal Spots

Flavescens shows a marked tendency towards more spots, especially in the males; this is almost equally marked in the females.

Flavia males show a similar inclination, but the females indicate a slight decrease towards the maximum amount of spotting.

Patmos shows a mean of 3 spots with a marked tendency in both sexes to lesser numbers with the maximum number of spots.

Subcentral Spots

Hindwing: *Flavescens* and *flavia* show a different distribution from *patmos* in numbers having a particular number of spots. *Patmos* males show a limitation of range to lower numerals; in the females the tendency is to a higher range. *Flavescens* females show a mean round one spot with a rather marked tendency towards two; *flavia* exhibits this tendency to a lesser degree. *Flavescens* males show a slightly decreasing inclination towards two spots, in contrast with *flavia* males which show a slightly increasing tendency. This again may be movement towards geographical change.

Order LEPIDOPTERA
Suborder RHOPALOCERA
Family SATYRIDAE

Geitoneura klugi insula n. subsp.

Male. Above: Forewing black with rich orange brown markings which are slightly more restricted than in mainland specimens (W.A.) and examples from

the eastern States. A white pupilled ocellus near apex, sexmark brown-black and extending from vein 4 to the mid-point of vein 1A. Tornus black, dorsum brown-black, cilia greyish.

Hindwing with central area rich orange brown, a central black band extending from vein 4 to vein 1B, a white pupilled ocellus in discal area at tornus and another smaller ocellus near apex. In most examples this ocellus shows the white pupil clearly but in some specimens it is reduced to a black spot. Cilia grey.

Beneath: Forewing similar to the upperside, apical ocellus larger and brighter, apex greyish black, sexmark absent, orange markings darker towards base.

Hindwing not nearly as variable as in typical *klugi*; light grey with rich brown-black striae and markings which are darker and generally more extensive than in the typical form. The central dark band sharply edged black. Ocelli faintly visible.

Female. Above: Similar to the male, markings orange but paler and more extensive; ocellus near apex white pupilled and clearly defined. Dorsum brown-black near tornus, almost merging to orange near base. Cilia grey.

Hindwing similar to the male but with orange area much more extensive, margins narrower, central dark band in some examples almost absent, only the portion near vein 4 being clearly visible, in others brown but less conspicuous than in the typical form. Cilia grey.

Beneath: Forewing similar to the upperside, apical ocellus larger and more distinct, apex grey finely suffused black, orange markings darker and richer near base.

Hindwing grey with dark brown and black striae and markings which are more numerous and generally darker than in mainland (W.A.) specimens and *klugi* from eastern Australia. The central dark band much less conspicuous than in the male, sharply edged black. Ocelli faintly visible. The black markings in the discal area are so numerous as to constitute an almost continuous greyish black area.

This race is considerably brighter than *klugi* from the mainland and on the wing presents quite a different appearance. *G. klugi* Guer. is a common butterfly in southern Australia and Tasmania, and as far as is at present known has not developed many geographical races, *G. klugi mulesi* Bns. from Wardang Island, S.A., being the only one so far described.

It is likely, however, that when further long series of specimens are collected and studied from South and Western Australia other races will be found. Specimens from the mainland of Western Australia, which at the nearest point is about 9 miles from Rottnest Island, are definitely distinct from this new race. The writer collected a number of specimens at Bunbury, Kings Park (Perth), and Wembley during November, 1947, and again in company with F. E. Wilson at the same and additional localities in November, 1948. Although the females are brighter in colour and appear different from eastern specimens, the males exhibit little difference. One male captured at the 64-mile post on the Geraldton road on 12.11.48 is smaller and paler than all other specimens collected, and at first glance resembles specimens from

the Grampians area in western Victoria. The collection of further material from this locality in the future will provide valuable data for study of this interesting butterfly.

It is worthy of note to mention that an allied species, *Geitoneura minyas minyas* Whs. and Lyell, is a common butterfly in coastal south-western Australia and so far has never been recorded from Rottnest Island. The distribution of *minyas* on the mainland is extensive, occurring from east of Albany in the south to north of Geraldton (*minyas mjobergi* Aur.) in the north, a total distance of at least 700 miles. F. E. Wilson and the writer collected intensively on Rottnest Island and examined many places which looked promising for *minyas,* but without result.

On the mainland both species fly freely together. *Minyas* appears on the wing about the first week of October, and persists until the end of November (Perth area); *klugi* appears towards the end of October and continues until December, so that by the end of October and beginning of November overlapping of both species occurs.

A large series of *minyas* was collected because of the great variation exhibited in this species; many females, especially those captured late in its season, bear a striking resemblance to *G. klugi* both on the upper and undersides of the wings. This variation is not a geographical one, because at all places where the insect was collected a similar range of variations was found. Much further interesting study remains to be done with regard to this species also.

I am indebted to Mr. L. Glauert, Director of the West Australian Museum, for valuable assistance and notes covering his observations made over a number of years and trips to Rottnest Island, and he states that he has never seen *G. minyas* there, althongh *G. klugi* is always plentiful.

Types in the collection of the writer.

Distribution. As known, Rottnest Island, 9 miles from the mainland of Western Australia, opposite Cottesloe.

Family LYCAENIDAE

Subfamily THECLINAE

Ialmenus icilius parvus n. subsp.

Male. Above: Forewing smoky brown with a large central area metallic green faintly tinged blue. The brown margins have a faint bronzy lustre. Cilia greyish brown.

Hindwing smoky brown with a large central area metallic green faintly tinged blue. Vein 2 prolonged into a short tooth at the base of which is a black dot above which again is a small faint almost obscure orange-brown marking. In

some specimens the black dot at the base of the tooth is absent. Cilia greyish brown.

Beneath: Forewing pale greyish brown with slightly darker markings which are narrowly edged greyish white. The intra-marginal markings run from the apex to the tornus, forming a slightly lunulated irregular band which is more clearly defined in some specimens than others. Cilia dull brown.

Hindwing as the forewing with rather darker markings which are narrowly edged greyish white. The intra-marginal band runs from the apex to the dorsum and, as in the female, is much more distinct in some specimens than others.

Female. Above: Forewing smoky brown, rather paler than in the male, with a large central area pale metallic blue. A narrow smoky brown marking interrupts the metallic blue at end of cell. Cilia greyish white.

Hindwing smoky brown, central area pale metallic blue, vein 2 prolonged into a short tooth at the base of which is a small black spot; above this, extending along each side, is a narrow orange-brown marking. In some specimens this marking is so pale that it is almost obscured. Some specimens show another minute black dot near the end of vein 1A. Cilia greyish white.

Beneath: Forewing as in the male; markings more variable, in some examples being so faint as to merge into the grey-brown colour of the wing, in others darker but usually not so conspicuously edged greyish white. Cilia dull greyish brown.

Hindwing as the forewing, markings as in the male, with the same degree of variation in individuals as stated for the forewing. In nearly all the specimens examined two black dots narrowly and obscurely edged orange-brown, one at the end of vein 2, the other near the end of vein 1A. Cilia dull greyish brown.

Microscope slides have been made of the male genitalia of both Geraldton and Walebing (W.A.) specimens, and examination shows them to be identical.

This race is much smaller, and the females considerably duller, than other specimens of *I. icilius* from Western Australia and the eastern States. A number of *icilius* was captured and bred from Walebing, 95 miles north of Perth along the Geraldton road, and these were quite typical, perhaps a little larger than the usual type of specimen from the eastern States. Further specimens were captured at National Park (F. E. Wilson), near Perth, and these were typical though definitely larger than normal eastern specimens.

Larvae and pupae of this new race were collected, these corresponding in habits and markings with the specimens from Walebing, and life history stages observed by the writer in western Victoria. Larvae and pupae were attended by a small black ant.

Food plant: A phyllode type of Acacia (*A. cyanophylla*?).

Distribution. Geraldton district, Moonyoonooka, Western Australia.

Types in the collection of the writer.

Ialmenus schraederi Felder

Through the courtesy of J. Macqueen of Milmerran, Queensland, I have been able to have photographs made of the larva and pupa of this interesting butterfly. A description of these was given in the Queensland Naturalist, Vol. 13, No. 4, August 1947, pp. 75-79, together with interesting notes regarding the habits, ant association, and feeding of this and another closely allied species, *Ialmenus ictinus* Hew.

In the adult stage *I. schraederi* and *I. ictinus* are practically indistinguishable. Mr. Macqueen has examined many specimens of each species and states as a result that he cannot find any single constant point of difference between them. Dr. Waterhouse, who is a notable authority on the subject, has seen and examined the same series of specimens, and he too agrees that no constant point of difference can be found. The writer has examined very carefully long series of *I. ictinus* and has compared them with a number of specimens of *I. schraederi* sent to him by Mr. Macqueen, and has come to the same conclusion. In some of the females of *I. schraederi* the metallic area of the wings appears to be very slightly tinged purplish-blue, but variation in the colour and its intensity also occurs in some examples of *I. ictinus.*

The larva of each species is very dissimilar in appearance, markings, and body features, and is in each instance attended by a different species of ant. *I. ictinus* is always attended by the common red Meat or Mound Ant (*Iridomyrmex detectus*), whilst *I. schraederi* is attended by a small reddish coloured ant (*Froggatella kirbyi*).

The food plant of both species is Brigalow (*Acacia harpophylla*), but Mr. Macqueen records having once taken *I. schraederi* on *Heterodendron diversifolium.* He further states that *I. ictinus* is widely distributed throughout the district (near Milmerran, Q.), whilst *I. schraederi* is very local and favours the same feeding trees year after year; and although the two species have been taken within ten feet of one another, each remained on its own food plant with its own particular species of ant.

Considerable differences exist in the shape and colouration of the pupa of each species. *I. ictinus* varies from pale brown to almost black in colour and is stouter and less elongate than that of *I. schraederi,* which is invariably black. Mr. Macqueen makes mention of the interesting fact that whilst *I. ictinus* pupates in twos and threes amongst the twigs or leaves of the food plant, those of *I. schraederi* (unless parasitized) are invariably found in sheltered places under bark or holes in fence posts some distance from the feeding tree.

Whilst figuring the larva and pupa of each of the above species, two pairs each of the butterflies of *I. ictinus* and *I. schraederi* have been photographed to show the identical appearance of both upper and undersides of the wings.

Recently I had the opportunity of examining further specimens of *I. schraederi* ?Feld. and agree with the later observations of Mr. J. Macqueen that in this species the costa of the forewing is not as straight as in *I. ictinus*; that the metallic area in *ictinus* females is more purplish, and in the males more bluish.

Both species occur during the summer months, from December until the end of March (Macqueen). The writer has had *I. ictinus* from the Rockhampton district in central coastal Queensland, New South Wales (near Paterson) and Victoria (Bacchus Marsh and Broadmeadows), and in each instance, though feeding on a different species of Acacia, the larvae and pupae have always been attended by the red Meat or Mound Ant (*Iridomyrmex detectus*). From each of these localities the specimens were obtained during the summer months, i.e., from December to March.

Ialmenus inous Hew.

Larva. Length (average) $\frac{7}{8}$ inch (20-22 mm.)

Colour: Dark brown, almost chocolate; dorsal line broad, brown; on either side a broad greyish brown longitudinal stripe, outside this a broad chocolate stripe marked intersegmentally with a narrow greyish stripe which is not continuous through the segments. Lateral area paler brown, with three interrupted pale greyish brown longitudinal stripes. Anterior segment with two flange-like projections directed forwards and carrying a number of long white setae. Central area of this segment depressed, with a large diamond-shaped shiny dark brown marking. Second and third segments each with a rounded projection which carries short dark-brown stiff bristles arising from pustules. Anal segment much depressed and carrying a shiny black plate. Pre-anal segment with two conical prominences bearing a stellate tuft of short white setae. Head retractile, black. Body ventrally pale yellowish green suffused pale green. Extreme lateral edges of segments with pale brown setae arising from small black pustules.

Larvae shelter during the day, either singly or in twos or threes, along the stems of the food plant just below ground level. They harmonize perfectly with their surroundings, and are always attended profusely by numerous brown ants (*Iridomyrmex gracilis*?) whose mound nests are usually close to the feeding shrubs. In habits larvae of *I. inous* greatly resemble those of *I. icilius*. Occasionally small larvae may be found resting in daytime along the young shoots of the food plant. Rarely larvae may be found with the chocolate coloured areas bright apple green.

Pupa. Length (average) $\frac{1}{2}$ inch (11-13 mm.).

Stout and much flattened ventrally. Attached by the tail and a central girdle to leaves, stems, debris or clods of earth, or the stem of the food plant just below ground level, and attended by ants.

Colour: Dull black, varying to greyish, irregularly blotched with black markings and spots; ventral area paler and with fewer and similar black markings. In some examples where the ground colour is greyish there is a pink suffusion. In no two pupae are the black markings similar in pattern.

Food plant: *Acacia cyanophylla.*

Locality. Western Australia, at Bunbury, Hamel, and Waroona, during the months of October, November and December. It is probable that butterflies may also be found from January to March. During the first week of November, 1947, at Bunbury butterflies were flying, and eggs, larvae in all stages, and pupae were collected.

Family HESPERIDAE
Subfamily TRAPEZITINAE

Description of the Larva and Pupa of *Anisyntoides argenteo-ornata insula* Whs.

Larva. Length (average) ¾ inch (18-20 mm.).

General body colour faintly pinkish grey, with a series of black angular longitudinal lines. Body surface closely granulate. Dorsal line narrow, slightly irregular, black, more clearly defined towards the anterior end of the body. On either side of this four irregular longitudinal lines, black, those nearest the dorsal line being the broadest and the others decreasing in width towards the lateral area.

Anal Plate slightly depressed, on this a median black line and a black crescent-shaped marking which joins the median marking at the anterior end and extending round the margins. The anal plate also carries a few minute black spots.

Head coarsely granulate; a nitid median broad marking extends from the vertex to the centre of the face, where it forks into two narrower markings each of which extends to the region of the mandibles. On either side of this a pale pinkish grey area which margins the black markings. Mandibles nitid, shining. Sides of head broadly and irregularly nitid and extending to lateral centre.

Ventral area of body pale pinkish white.

In general appearance the larva of this butterfly bears a strong resemblance to that of *Trapezites luteus* Tepper., and the habits and flight of the butterfly to that species also.

The larva was first taken by F. E. Wilson on Rottnest Island, Western Australia, on 1st November, 1948, and the pupa by the writer on 27th October, 1947.

Unlike the larvae of *Trapezites,* which construct shelters of leaves drawn together and situated right at the base of the food plant, the larva of this insect spins a whitish cocoon which is open at one end and which is usually situated amongst the foliage quite near the top of the food plant.

A larva of the mainland form was collected at Bunbury, W.A., on 5.11.48.

Food plant: *Acanthocarpus pressii.*

Pupa. Enclosed within a white silky cocoon which is open at the top or placed between several leaves of adjacent grass or similar plants which are incorporated into a cocoon-like structure.

Length $\frac{5}{8}$ inch (12-14 mm.). Stout, resembles a *Trapezites* pupa.

Colour: Light brown, darker dorsally and in the region of the legs and antennae ventrally. Eyes prominent.

Operculum not well defined, small, rounded, irregularly furrowed and bearing short greyish setae. Another tuft of setae on each side of the prominence above the eyes, so that they are almost surrounded with setae.

Whole of dorsal area and abdomen finely clothed with short greyish setae, dorsal area marked with darker brown irregular transverse lines.

Cremaster long, dark brown and curved forwards.

Locality. Western Australia at Rottnest Island during October and November. Also recorded from Monte Bello Island and the Abrolhos Islands.

The butterflies are attracted to flowers of several species; those most frequently visited are Senecio and a yellow flowering tussocky herbaceous plant, *Conostilis radicans.*

The food plant (*Acanthocarpus preissii*) of this insect was observed at Bunbury, Wembley, Rottnest Island and Geraldton.

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EXPLANATION OF PLATES

Plate I

Fig. 1. *Hesperilla flavescens flavescens* Whs.
(a) Larva, lateral view.
(b) Head of larva, front view, enlarged.
(c) Male pupa.
(d) Operculum of male pupa, enlarged.
(e) Operculum of female pupa, enlarged.
(f) Female pupa.

Fig. 2. *Hesperilla flavescens flavia* Whs.
(a) Larva, lateral view.
(b) Head of larva, front view, enlarged.
(c) Male pupa.
(d) Operculum of male pupa, enlarged.
(e) Operculum of female pupa, enlarged.
(f) Female pupa.

Fig. 3. *Hesperilla donnysa patmos* Whs.
(a) Larva, lateral view.
(b) Head of larva, front view, enlarged.
(c) Male pupa.
(d) Operculum of male pupa, enlarged.
(e) Operculum of female pupa, enlarged.
(f) Female pupa.

Fig. 4. *Ialmenus inous* Hew.
(a) Larva, lateral view.
(b) Larva, dorsal view.
(c) Pupa, lateral view.
(d) Pupa, dorsal view.

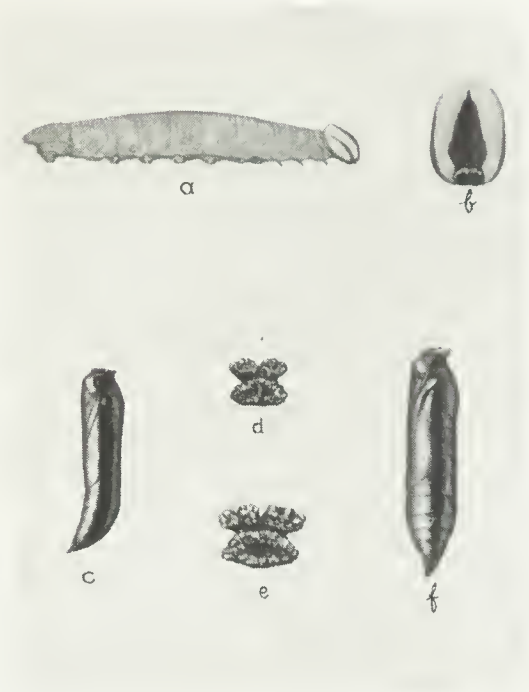
Plate II

Fig. 1. *Hesperilla flavescens flavescens* Whs.

(a)-(f) Males, the last one in the series (f) showing the underside.
(g)-(l) Females, the last one in the series (l) showing the underside.
These specimens were chosen from long series to show the extremes of range in markings.

Fig. 2. *Hesperilla flavescens flavia* Whs.

(a)-(f) Males, the last one in the series (f) showing the underside.
(g)-(l) Females, the last one in the series (l) showing the underside.
These specimens were chosen from long series to show the extremes of range in markings.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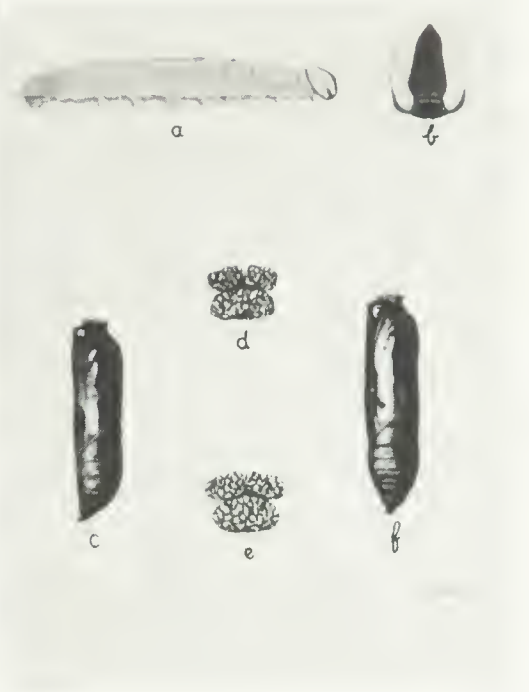
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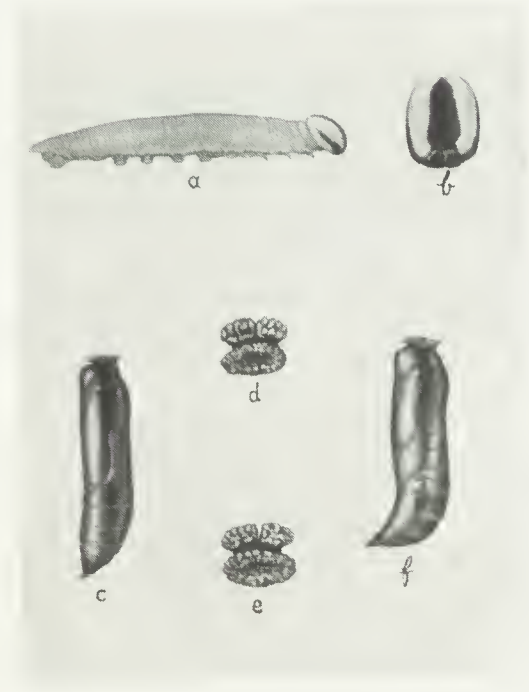
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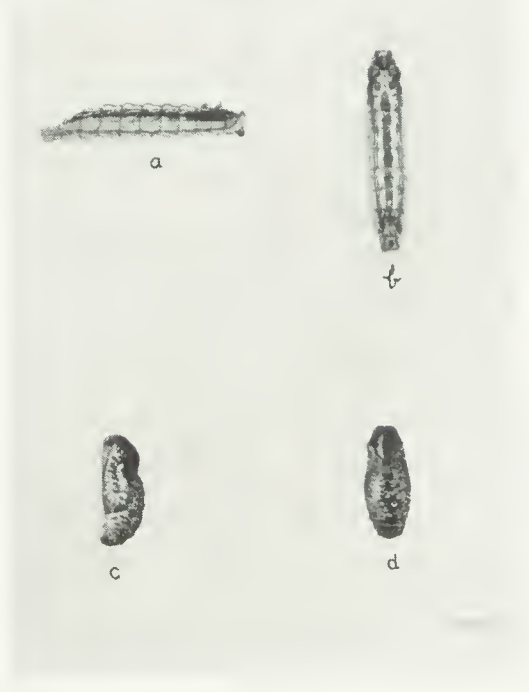
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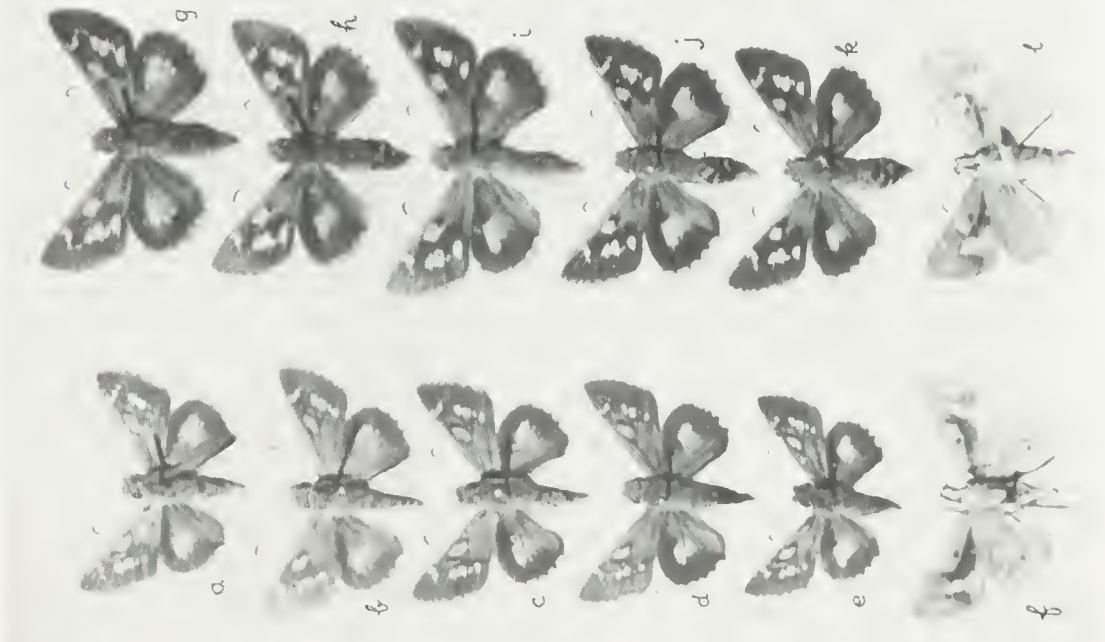
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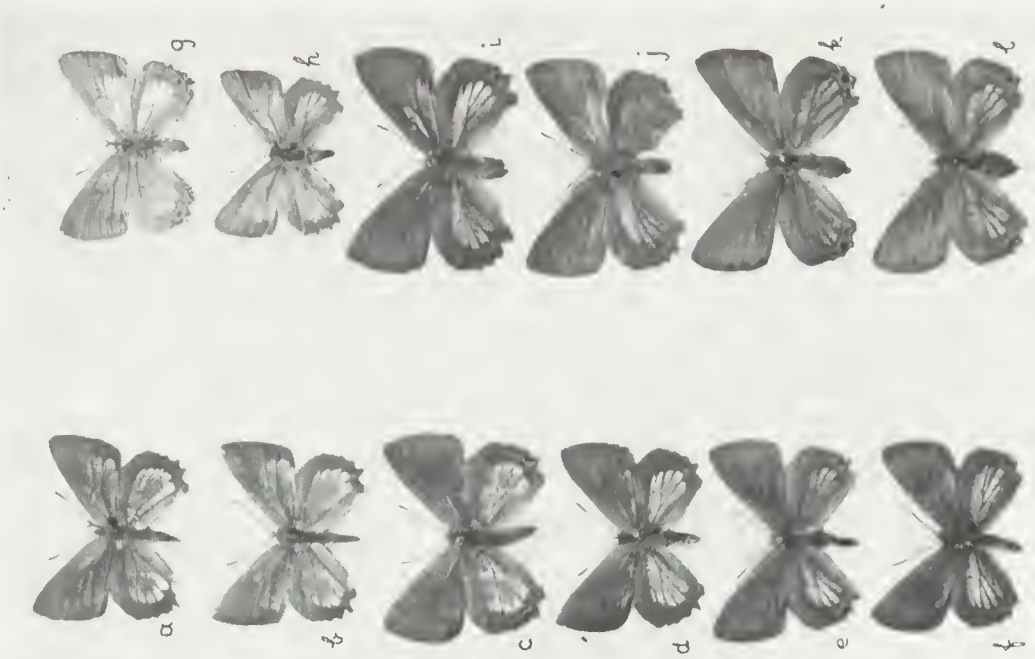
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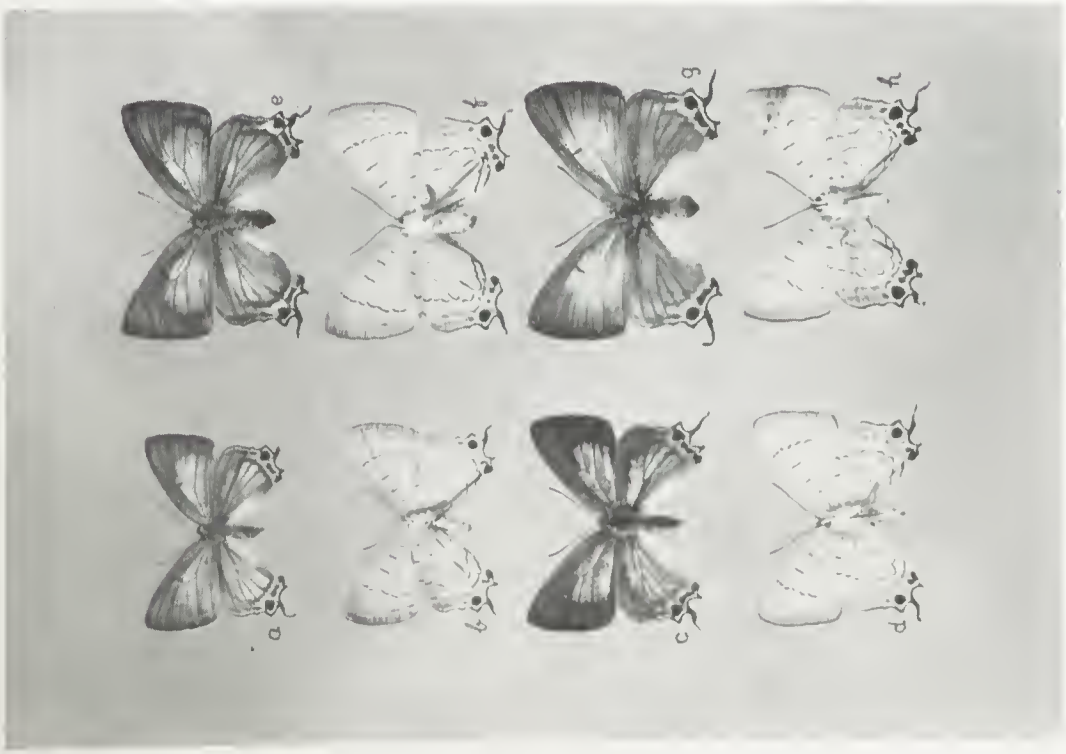
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Plate III

Fig. 1. *Hesperilla donnysa patmos* Whs.
(a)-(f) Males, the last one in the series showing the underside.
(g)-(l) Females, the last one in the series showing the underside.
These specimens were chosen from long series to show the extremes of range in markings.

Fig. 2. (a) *Geitoncura klugi insula* n. subsp. Male.
(b) *Geitoncura klugi insula* n. subsp. Male, underside.
(c) *Geitoneura klugi klugi* Geur. Male, underside.
(d) *Geitoneura klugi klugi* Geur. Male.
(e) *Geitoneura klugi insula* n. subsp. Female.
(f) *Geitoncura klugi insula* n. subsp. Female, underside.
(g) *Geitoneura klugi klugi* Guer. Female.
(h) *Geitoneura klugi klugi* Guer. Female, underside.

Plate IV

Fig. 1. (a) and (b) *Ialmenus icilius parvus* n. subsp. Males. Geraldton, W.A.
(c) and (d) *Ialmenus icilius icilius* Hew. Males. Walebing, W.A.
(e) and (f) *Ialmenus icilius icilius* Hew. Males. Western Grampians, Vic.
(g) and (h) *Ialmenus icilius parvus* n. subsp. Females. Geraldton, W.A.
(i) and (j) *Ialmenus icilius icilius* Hew. Females. Walebing, W.A.
(k) and (l) *Ialmenus icilius icilius* Hew. Females, Western Grampians, Vic.

Fig. 2. (a) *Ialmenus schraederi* ?Feld. Male, upperside.
(b) *Ialmenus schraederi* ?Feld. Male, underside.
(c) *Ialmenus ictinus* Hew. Male, upperside.
(d) *Ialmenus ictinus* Hew. Male, underside.
(e) *Ialmenus schraederi* ?Feld. Female, upperside.
(f) *Ialmenus schraederi* ?Feld. Female, underside.
(g) *Ialmenus ictinus* Hew. Female, upperside.
(h) *Ialmenus ictinus* Hew. Female, underside.

Plate V

Fig. 1. *Anisyntoides argenteo-ornata insula* Whs.—mature larva.
Fig. 2. *Anisyntoides argenteo-ornata* Whs.—pupa, lateral view.
Fig. 3. *Anisyntoides argenteo-ornata insula* Whs.—mature larva.
[Photography by M. W. Mules.]

Plate VI

Fig. 1. *Ialmenus schraederi* ?Feld.
(a) Young larva.
(b) Mature larva.
(c) Pupa.
Fig. 2. *Ialmenus ictinus* Hew.
(a) Mature larva.
(b) Pupa.